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Exploring long-range antiferromagnets with single-site resolution[1] CHRISTIE S. CHIU, ANTON MAZURENKO, GEOFFREY JI, MAXWELL F. PARSONS, MARTON KANASZ-NAGY, RICHARD SCHMIDT, FABIAN GRUSDT, EUGENE DEMLER, DANIEL GREIF, MARKUS GREINER, Harvard University — Quantum gas microscopy of ultracold fermionic atoms in optical lattices opens new perspectives for addressing long-standing open questions on strongly correlated low-temperature phases in the Hubbard model such as doped antiferromagnets. Using site-resolved potential engineering for improved cooling, we demonstrate long-range antiferromagnetic order extending over our entire sample, a disk extending ten sites across filled with a two-component spin mixture of ultracold fermionic Li-6 atoms in a square lattice. We measure the site-resolved spin correlation function and find the correlation length to be comparable to the system size. The order is also detected from a sharp momentum peak in the spin structure factor and the onset of a non-zero staggered magnetization. We further explore the phase diagram of the Hubbard model by studying magnetic order when doping the system away from half-filling a regime where precise numerical studies become challenging. We additionally discuss our progress towards achieving order for larger system sizes and observing the dynamics of a deterministically placed hole in spin backgrounds of varied magnetic order.

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